

Worksheet: Radioactivity

Name: _____ Group name: _____

Safety note: The sources you will use today are all very low activity and quite safe. However, you should still use precaution. Do not have any food in the lab and don't ingest anything. Wash your hands thoroughly once class is done.

1. Measure the beta/gamma radiation background at various locations in the room with the Geiger counter.

(a) Record the rate for the background by measuring it for some time, then divide by the time recorded (the less counts you get per second, the longer you should measure):

$$R = \text{_____ counts/min.}$$

(b) Assume a conversion factor of that **1 $\mu\text{Sv/h} = 120 \text{ counts/min}$** and convert this to a dose:

$$A = \text{_____ } \mu\text{Sv/h}$$

(c) Where do you think the background is coming from?

2. Your Grandfather just gave you an old clock that, unbeknownst to him, contains radium "glow in the dark" paint.

(a) Measure the radiation field 5 inches from the radium clock.

$$A = \text{_____ } \mu\text{Sv/h}$$

(b) Assume you place the watch on your headboard 5 inches from your pillow on your bed. If you leave it there for 1 year (365 days) and we assume that you sleep in your bed 8 hours every night, what will be the radiation dose to your head after 1 year?

$$\text{Exposure time: } t = \text{_____}; \text{ Dose: } H = \text{_____}$$

- (c) Consult the prelab: is this a safe dose? (Remember that $1000\mu\text{Sv} = 1\text{mSv}$)
3. Measure the beta/gamma radiation from a piece of pottery with radioactive uranium glaze (Fiestaware) at 5 cm, 15 cm and 30 cm from the pottery.
- (a) Record the values and try plotting the activity over the distance. Remember to subtract background from the readings.
- (b) Answer the question “How does distance affect radiation?” based on your data.
- (c) People used to **eat** off of these plates. Assume that you by eating, you ingest an alpha source, which embeds itself into your bone marrow and delivers a dose of $20\mu\text{Sv/h}$ over 10 years. What are the expected health effects?
4. Measure the beta/gamma radiation from one of the sources. Record the value.
- (a) Put the different types of shielding between the source and the Geiger counter, and measure the beta/gamma radiation field.

(b) How did the different types of shielding change the radiation rates?

5. Study the cloud chamber in the lab with one of the welding rods in the middle.

(a) What types of tracks do you observe? Draw them.

(b) Note that the cloud chamber has a magnetic field inside, and that **charged** particles will bend their trajectories in a magnetic field. More massive particles will bend less, because they have higher inertia.

Particle	Charge	Mass	Trajectory in magnetic field
alpha			
beta -			
beta +			
gamma			

(c) What are the sources of radiation that are made visible by the cloud chamber?